Woodward-Clyde Consultants

FINAL REPORT ON THE 8T REMEDIATION AT THE DOUGLAS AIRCRAFT COMPANY TORRANCE (C6) FACILITY

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> > FINAL



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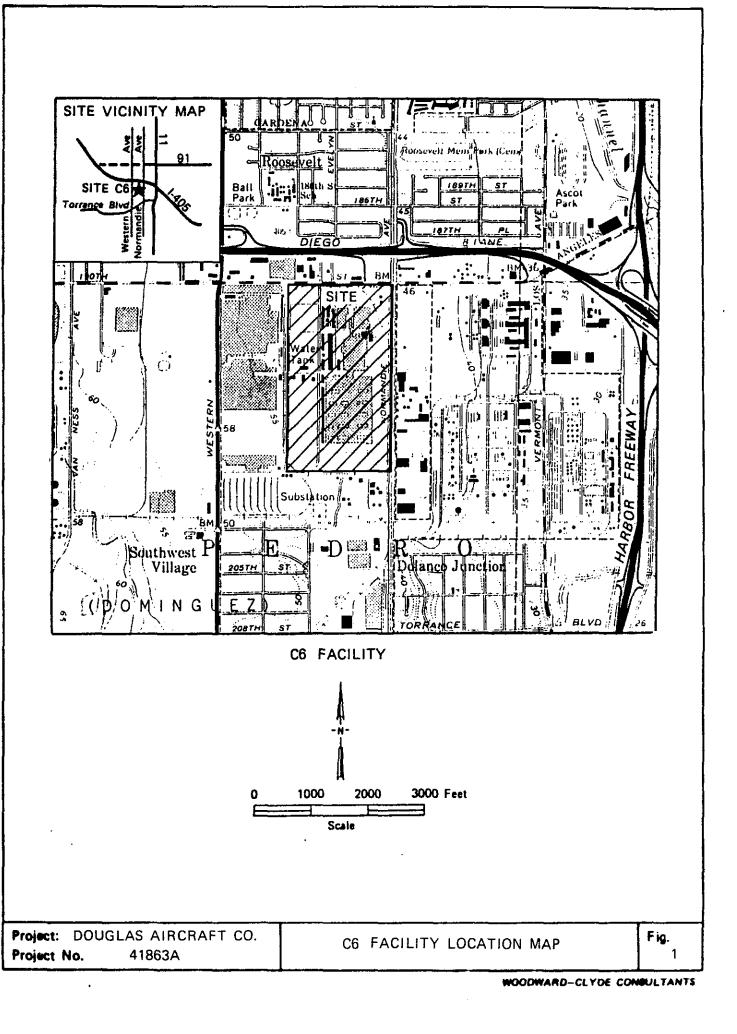
1.0 INTRODUCTION

The purpose of this report is to present the results of the investigation conducted at Tank 8T at Douglas Aircraft Company's C6 facility, and the method of remediation that was implemented. The sequence of activities leading to the remediation is discussed in this section. In the other sections of this report, a discussion of the field operations conducted, and the analytical results obtained during the program are discussed.

On 11 March 1987, petroleum hydrocarbon odors were noticed during the removal of Tank 8T at the Torrance, C6 facility (see Figure 1). Tank 8T was a 10,000 gallon waste coolant tank. During the removal of an adjacent concrete sump that drained into the tank, approximately 200 to 400 gallons of liquid were released into the north end of the excavation.

On 11 and 17 March, 1987, six soil samples were collected from the bottom of the excavation by personnel working for Macco Construction Company. The analytical results obtained from these soil samples indicated that hydrocarbons were present in the soil, but they were limited to the north end of the excavation. Laboratory analysis reports of these soil samples are presented in Appendix C.

Woodward-Clyde Consultants conducted a preliminary investigation to evaluate the vertical extent of hydrocarbons. This investigation involved drilling two angled borings (B-1)



and B-2) under the north end of the excavation, and one angled boring (B3) under the south end of the excavation. Figure 2 presents the boring locations. Results from this investigation are presented in Woodward-Clyde Consultants' report "Evaluation of the Presence of Petroleum Hydrocarbons in the Subsurface at Tank 8T at DAC's Torrance Facility," dated August 1987. Analytical results from soil samples collected from borings B-1, B-2, and B-3 indicated that the petroleum hydrocarbons were limited to the north end of the excavation, and extended to a vertical depth of approximately 15 to 20 feet below the bottom of the excavation (31 feet below grade). A summary of the soil hydrocarbon concentrations is presented in Table 1. Analytical results and chain-of-custody forms are presented in Appendix D.

Woodward-Clyde Consultants initially recommended excavating soil with elevated hydrocarbon concentrations remediating the soil by the Ensotech treatment process. This process basically involves mixing the soil with liquid hydrogen peroxide and a catalyst, resulting oxidization of the hydrocarbons to carbon dioxide and water. A Variance Application for a permit to conduct on-site treatment of hazardous waste was submitted to the California Department of Health Services (DHS). The permit was never approved for this process because of unresolved issues between the state and local regulatory health agencies regarding who would approve variance applications (telephone conversation of 19 November 1987 between Alistaire Callender of Woodward-Clyde Consultants and Susan Romero of the DHS). Because a variance could not be obtained, the soil with elevated hydrocarbon concentrations was disposed of at the Imperial Valley Landfill, and was not remediated on-site as initially intended.

TABLE 1
SOIL PETROLEUM HYDROCARBON CONCENTRATIONS (mg/kg)

Boring Number	Sample Date	Sample Number	Depth ¹ (ft)	Gasoline	Diesel Fuel	Kerosene	Mineral Spirits	C18-C30+ Hydrocarbons
81	4/10/87	3	12	ND ²	ND	3030	ND	1300
81	4/10/87	5	18	ND	ND	ND	ND	ND
81	4/10/87	6	21	ND	ND	ND	ND	ND
B1	4/10/87	7	26	ND	ND	ND	ND	ND
B2	4/10/87	2	12	ND	ND	ND	ND	ND .
B2	4/10/87	2 3 4 5 6	17	ND	ND	ND	ND	ND
B2	4/10/87	ž	22	ND	ND	9500	ND	9700
B2	4/10/87	5	27	ND	ND	1900	ND	2800
B2	4/10/87	6	31	ND	ND	ND	ND	4600
B2	4/10/87	7	38	ND	ND	ND	NĎ	ND
в3	4/10/87	1	21	ND	ND	ND	ND	ND
83	4/10/87	2	26	ND	ND	ND	ND	ND ND
B3	4/10/87	3	30	ND	ND	ND	ND	ND
- 55	47 10707				ND	- 10	- 10	
84	12/1/87	3	12	ND	ND	ND	ND	ND
B4	12/1/87	4	17	ND	NO	ND	ND	ND
В4	12/1/87		22	ND	ND	6400	ND	27,000
В4	12/1/87	5 6 7	27	ND	ND	72	ND	360
B4	12/1/87	7	32	ND	ND	ND	ND	ND
в5	12/17/87	1	17	ND	ND	ND	ND	ND
B5	12/17/87	ż	22	ND	ND	150	ND	1000
B5	12/17/87	3	27	ND	ND	1100	ND	5800
B5	12/17/87	4	32	ND	ND CN	4200	ND	5900
B5	12/17/87	5	37	ND	ND	D	ND	ND
	((10 (07	4	<u> </u>	NO	MD	ND	ND	310
SP	4/10/87	1		ND	ND	ND ND	ND ND	680
SP	4/10/87	2		ND	ND	ND	NU	000
8TPL	12/1/87	3		ND	ND	ND	NĐ	ND
8TPL	12/1/87	5		ND	NÐ	ND	ND	ND
8TPL	12/1/87	7		ND	ND	ND	ND	ND
Sample	12/17/87	1		ND	ND	ND	ND	550
Sample	12/17/87	2		ND	ND	ND	ND	540
Sample	12/17/87	3		ND	ND	ND	ND	ND
SP	1/5/88	1	30	ND	ND	ND	ND	ND
SP SP	1/5/88		35	ND	ND	ND ND	ND ND	160
SP SP	1/5/88	2 3 4	22	ND ND	ND ND	ND	ND ND	ND
SP	1/5/88	2	30	ND	ND	ND	ND	ND
SP	1/5/88	5	35	ND	ND	ND	ND	ND
Trench	1/8/88	1A	8	ND	ND	ND	ND	ND
Detection			10	10	10	10	100	

¹ Depth to nearest foot

² Not Detected

⁽L-ABC/DAC8T-1)

2.0 APPROACH

The approach to remediating the soil at Tank 8T involved four tasks. Task I included drilling two additional borings (B4 and B5) and soil sampling at the north end of the excavation, to further evaluate the vertical hydrocarbons in the soil. Task II involved the actual excavation of soil from the north end of the excavation using as a guide, OVA headspace readings, and laboratory analysis of soil samples from the excavation, and visual observations of the soil. Task III involved the collection of samples from the sidewalls and bottom of the excavation to evaluate if all of the soil with elevated hydrocarbon concentrations had been removed. Task IV included backfilling the excavation with a cement slurry to provide a backfill material that would not require compaction. general approach was submitted in a letter to Mr. Jeff Copeland of the Los Angeles Regional Water Quality Control Board, dated 29 December 1987, and verbally approved by Mr. Copeland on 31 December 1987. A copy of this letter is attached as Appendix E.

3.0 FIELD OPERATIONS

3.1 Task I

As a part of Task I, two additional borings (B-4 and B-5) were drilled on 1 and 17 December 1987. The locations of borings B-4 and B-5 are shown in Figure 2. Drilling for both borings was conducted by A&R Drilling, Inc. using a CME 75 drill rig with 7-inch O.D. hollow stem augers. Soil samples were collected at approximately 5-foot intervals using a modified California sampler, and sealed in brass tubes. Appendix A presents additional information on the field procedures. Boring Logs for B-1 through B-5 are presented in Appendix B. Soil samples were selected for

analyses based on Organic Vapor Analyzer (OVA) headspace readings and field observations. The soil samples were analyzed for petroleum hydrocarbons by EPA Method 8015 modified. Analytical data and chain-of-custody forms from borings B-4 and B-5 are provided in Appendix D and summarized in Table 1. Analytical data from B-4 and B-5 indicated the presence of hydrocarbons to a vertical depth of 32 to 35 feet below the ground surface.

3.2 Task II

Task II involved the excavation of soil from 8T on 4 January 1988 by G.L. Patterson Equipment, Inc. A GradeAll G-1000 with a superboom extension was used for excavating the soil. The soil to be excavated could be generally identified by its greenish-gray color. An OVA was used during the excavation to obtain headspace readings from the soil, and to assist in evaluating if hydrocarbons were present.

3.3 Task III

Task III was completed on 5 January 1988 and consisted of the collection of five soil samples from the sidewalls and the bottom of the excavation. The task objective was to evaluate whether all the soil with elevated hydrocarbons had been removed. On 5 January 1988, samples SP-1 and -2 were collected from the bottom of the excavation, while SP-3, -4, and -5 were collected from the sidewalls. Analytical results obtained from SP-1, -2, -3, -4, and -5 are presented in Appendix D and summarized in Table 1. The sampling locations of SP-1, -2, -3, -4, and -5 are presented on Figure 2.

During excavation of the northwest sidewall, a cast-iron 4 to 5 inch diameter tank inlet pipe was exposed, approximately 6 to 7 feet below grade. A 6- to 12- inch

band of greenish-gray staining was observed directly below the pipe. On 8 January 1988, 10 feet of the tank inlet pipe removed by California Backhoe, Inc. The excavated trench was approximately 8 feet in depth. A greenish-gray discoloration was observed 6 to 12 inches below the pipe and 6 to 8 feet laterally into the trench backfill. One soil sample (Trench-1A) was collected from below the discolored soil at a depth of approximately 8 feet to evaluate the vertical extent of hydrocarbons. Soil with elevated OVA headspace measurements was removed from the excavation. Analytical results for soil sample Trench 1A are presented Appendix and summarized in Table D 1. illustrates the sampling location.

3.4 Task IV

Task IV activities consisted of backfilling and resurfacing the excavation, and were initiated after the analytical results confirmed that soil with elevated hydrocarbons had been removed. On 6 January 1988, A&A Ready Mix Concrete, Inc. poured 400 cubic yards of a 2-sack cement slurry into the 8T excavation. The slurry was placed to a level about 4-1/2 feet below the existing grade. On 12 January 1988, 3 feet of soil was compacted over the cement slurry. upper 1 foot of soil was compacted to at least 95 percent of the maximum dry density, as determined in accordance with ASTM Test Method D1557 (i.e., 95 percent compaction). Soil used for compaction was taken from the "clean" soil (soil with no detectable petroleum hydrocarbons) that was removed from the excavation. Analytical results from soil samples collected from the soil piles are discussed in Section 3.5. The excavation was resurfaced with 5 to 6 inches of asphalt, over 10 to 12 inches of crushed aggregate base material on 19 January 1988

TABLE 2 FIELD DENSITY TEST RESULTS

JOB NAME: Douglas Aircraft Company, Torrance, 8T Excavation JOB NUMBER: 8741863D

Date	Test Number	Location	Field Moisture % Dry Weight	Field Dry Density (pcf)	Laboratory Maximum Dry Density (pcf)	Relative Compaction % of Lab Density
2 January 1988	3 1	8T Pad	18.5	118	121	98
12 January 1988	3 2	8T Pad	19.0	120	121	99
12 January 1988	3	8T Pad	15.5	116	121	96
12 January 1988	3 4	8T Pad	17.5	120	121	99
8 January 1988	5	8T Pad	16.0	115	121	95
8 January 1988	6	8T Pad	16.0	113	121	93
9 January 1988	3 7	Base Material	6.0	136	143	95
9 January 1988	8	Base Material	6.0	142	143	99
19 January 1988	9	Base Material	6.0	137	143	96

(L-ABC/DAC8T-T2)

Sully-Miller Contractors. The crushed aggregate base material was compacted to at least 95 percent relative compaction (see Table 2).

Laboratory soil compaction tests were conducted on three soil samples, SK-1, -2, and -3 to estimate the maximum dry density and the optimum moisture content (see Table 3). Soil samples SK-1 and SK-2 were from the "clean" soil pile used for compaction from 1-1/2 to 4-1/2 feet below grade, and soil sample SK-3 was from the crushed aggregate base material.

3.5 Soil Stockpile

Soil excavated from the 8T excavation was segregated into two piles. The soil with elevated petroleum hydrocarbons was evaluated and segregated by OVA headspace measurements, visual discoloration, hydrocarbon odor, and laboratory analysis.

Eight soil samples from the soil stockpiles were analyzed for petroleum hydrocarbons by EPA Method 8015 modified. Soil samples (SP-1, SP-2, Sample-1 and Sample -2) were collected on 10 March 1987, and 17 December These soil samples were collected from the respectively. "dirty" soil stockpile and ranged in concentration from 310 to 680 mg/kg of C₁₈-C₃₀₊ hydrocarbons. Soil samples 8TPL-3, 5, 7, and Sample-3 were collected on 1 December 1987 and 17 December 1987, respectively. These samples were collected from the "clean" soil stockpile and did not indicate the presence of petroleum hydrocarbons (i.e., hydrocarbons were not detected). Analytical results are summarized in Table 1, and laboratory data sheets are presented in Appendix D. Approximately 180 cubic yards of with soil

TABLE 3

LABORATORY COMPACTION TEST¹ RESULTS

_	Sample	Soil Type ²	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
_	SK-1	Silty Clay (CL)	122	11.5
	SK-2	Silty Clay (CL)	127	10.0
	SK-3	Base Material	143	4.5

¹ ASTM Test Method D1557

² Unified Soil Classification given in parenthesis

hydrocarbon concentrations were removed from the 8T excavation. The soil was taken to a landfill in Imperial Valley, California on 25 and 26 January 1988.

4.0 SUMMARY

Analytical results were obtained from samples collected from borings B-4 and B-5 installed on 1 December and 17 December 1987, and indicated a maximum vertical depth of petroleum hydrocarbons of 32 to 35 feet below grade. Soil from the north end of the 8T excavation was removed to a depth of approximately 35 feet below grade on 4 January 1988. Five soil samples were collected on 5 January 1988 from the sidewalls and bottom of the excavation to confirm that the soil containing hydrocarbons had been removed from excavation. Analytical results did not indicate detectable quantities of petroleum hydrocarbons in samples SP-1, -3, -4, and -5. Sample SP-2 indicated the presence of 160 mg/kg of C₁₅-C₃₀ hydrocarbons at the bottom of the excavation. results from the soil sample, collected from below the 8T tank inlet pipe did not indicate the presence of hydrocarbons. A summary of the analytical results are listed in Table 1, and Appendix D presents the laboratory data sheets. Soil from the excavation "clean" "dirty" stockpiles. segregated into and samples collected from the "dirty" stockpile indicated the presence of hydrocarbons ranging from 310 to 680 mg/kg. Soil samples from the "clean" stockpile do not indicate the presence of hydrocarbons. An estimated 180 cubic yards of soil containing hydrocarbons was removed from the tank and inlet pipe excavations and hauled to Imperial Valley Landfill on 25 and 26 January 1988 by IT Corporation.

On 6 January 1988, Mr. Jeff Copeland of the Los Angeles Regional Water Quality Control Board, visited the 8T site to inspect the soil excavation and to review analytical data obtained from soil samples SP-1, -2, -3, -4, and -5. Mr. Copeland verbally approved that the excavation had sufficiently removed the hydrocarbons from the soil, and that the excavation could be backfilled.

The excavation was backfilled with 400 cubic yards of a 2 sack cement slurry to 4-1/2 feet below grade and with 3 feet of soil compacted to 95 percent to 1-1/2 feet below grade. The excavation was resurfaced and brought to grade with 5 to 6 inches of asphalt over 10 to 12 inches of crushed aggregate base material.

APPENDIX A

FIELD PROCEDURES

APPENDIX A

FIELD PROCEDURES

A.1 GENERAL INFORMATION

Drilling was performed by A & R Drilling, Inc. of Carson, California. Borings B-1, -2, and -3 were auger drilled on 10 April 1987. Boring B-4 and B-5 were drilled on 1 December 1987 and 17 December 1987, respectively. Borings were drilled using a CME 75 with a 7-inch hollow stem auger.

A.1.1 Soil Borings

Soil borings were generally drilled from 30 to 50 feet in depth. Borings were backfilled with a dry mixture of 75 percent No. 60 Silica sand and 25 percent of bentonite powder after completion of soil sampling. The dry mixture of bentonite and sand serves as a low permeability plug to minimize water infiltration through the borehole. The top 6 inches of the borings were backfilled with asphalt.

A.1.2 <u>Drill Cuttings</u>

Drill cuttings from each boring were placed in 55-gallon drums. The contents of the drums were labeled using an identification label and permanent ink marker. The drums were sealed and left adjacent to the boring locations. Douglas Aircraft was advised of the locations and contents of the drums, and the need for proper management of the drill cuttings.

A.2 SOIL SAMPLING

Subsurface soil samples were collected at about 5-foot intervals. The Boring Logs, presented in Appendix B, illustrate the soil sampling locations for each boring. Soil samples were taken for Organic Vapor Analyzer (OVA) headspace measurements and laboratory analyses. The soil samples were collected using a modified California sampler for borings drilled by the CME 75. The modified California sampler holds four brass tubes, and is 18 inches in length.

Soil samples from the soils pile stockpiled adjacent to the excavation were collected by the "grab" sampling method. This method simply involved packing loose soil from the stockpile into a brass tube for laboratory analysis.

A.2.1 OVA Headspace Measurements

Field OVA headspace measurements were taken from each soil sample. This procedure was conducted by extruding approximately one brass or stainless steel tube from each soil sample into a one pint glass jar. The jar's lid had a 1/4-inch diameter hole, which was sealed with duct tape. Approximately 10 minutes were allowed for organic vapors from the soil to reach equilibrium inside the jar. An OVA probe was then inserted through the hole in the jar, and the vapor concentration was measured.

A.2.2 Soil Sample Preparation

One to two tubes from the soil sampler were prepared for laboratory analysis. The ends of the tubes were covered with aluminum foil, plastic end caps, and sealed with electrical tape. Soil samples were labeled with the following information:

- o Project number
- o Project name
- o Boring number
- o Sample number
- o Soil depth
- o Sampler's signature
- o Date

The soil samples were then sealed in Ziploc plastic bags and placed on ice in an ice chest. All of the soil samples were delivered to West Coast Analytical Service, Inc. in Santa Fe Springs for laboratory analysis. Chain-of-custody procedures, including the use of sample identification labels and chain-of-custody forms, were used for tracking the collection and shipment of soil samples. The chain-of-custody forms are presented in Appendix D.

A.2.3 Field Observations

Observations by Woodward-Clyde Consultants' personnel during the drilling and sampling operations were recorded on Boring Logs, as presented in Appendix B. A qualified geologist recorded observations related to visual soil classifications, geologic and stratigraphic comments, sampling efforts, OVA measurements, and other pertinent information. APPENDIX B

BORING LOGS

ORING OCATI MILLI	ON B-1 (81) See Tigure 2			AND	Ď/	TUI		2.0-	Not Available	
GINC	Y A & h Drilling	S. Kost	fer	ĦΑ	Īξ	D.,		0-87		0-87
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7 0	Asphalt	, orraci				В.	Jacol	os	M. Razmd	joo
		GRAP	HIC LO	ig]		\$AI	APLE	S	l :	
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1	·	-7]				ļ			reading = 1-2 ρ	
5	Damp, light olive, very fine to medium grained SAND (SW-SM) with little silt.	+++++++++++++++++++++++++++++++++++++++		4	1	X				
	Damp, olive, SILTY CLAY (CL) with some fine sand.	- - -		4	2	X			Oily Odor	
5	Damp, olive with black mottling, CLAYEY SILT (ML) with fine sand.			16	3	Χ			Oily Odor	
0 +	Damp, reddish brown, SANDY SILT (MC).	+++++		26 64		X			Oily Odor	
Ľ	Increasing sand. Becoming clayey.	+		14	6	X			Oily Odor	
•		+		13	7	X			Slight Odor	
¯ †	Bottom of Boring at 30 feet. Total Vertical Depth at 27 feet.	+ + + + + + + + + + + + + + + + + + + +							Boring drilled at 2 vertical. Bearing S	
rojec Projec	CT: DOUGLAS AIRCRAFT TORRANCE CT No.: 41863B	3-1 (8T)	L	OG	(F	8	ORII	NG	Fig.

	TION . B-2 (81) See Tigure 2		į	ELE'	מ (TU	М		Not Available	
	NG A & R Drilling DRILLER	S. Kos	fer	낈	ĔŢ,			10-87		-87
	ING CME 75, 7-inch O.D., H.S.A.			Sept.	Į, į	Ţįo		45	POCK DEPTH(FT)	
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	ONA I ION		—∤	LOG		<u>(FT</u>			CHECKED BY	
ACK	FILL 80% No. 60 Silica Sand and 20% Bentonite Po	wder	∤				Jaco	hs	M. Razmdje	00
EAL	Asphalt	I GO A	HIC FO	G 1			MPLE		1 110	-
(FEET)	DESCRIPTION	Sept of the sept o	1 2	VÎ.	9		COMM		REMARKS	
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	Damp, reddish-brown, SANDY SILT (ML) with some clay.								reading = 1.5 p	
5-	Damp, dark brown to black, SILTY CLAY (CL).									
	Damp, olive, SILTY CLAY (CL).									
1	Damp, reddish-brown, SILTY CLAY (CL).			2.4	1	X				
10										
	Damp, light olive, CLAYEY SILT (ML).	+		5	2					
15									Slight Odor	
20	Damp, dark olive with greenish-black staining,			80	3	X			Moderate Odd	or
-	CLAYEY SILT (ML).									
25				120	4	X			Moderate Odd	or
† + +	▼ Becoming more clayey.	•		120	5	X			Moderate Odo	r
υ	y Decoming more clayey.									
15	Damp, reddish-brown, fine grained SAND (SP-SM) with little silt.			40	6	X			Slight Odor	
roje	TORRANCE B.	2 (8T)]) G	L C)F	80	DRI	NG	Fig A-
roje	oct No.: 41863B	, , <i></i>		_	_	•		•	· · -	~

		GRAP	HIC LO	G		\$A	MPLE	s		
DEPTH (FEET)	DESCRIPTION	J. stroket	Observa- tion Well	OVA (ppm)	No.	Type	Blow	Drilling Rate/ Time	REMARKS	
	Damp, reddish-brown, very fine grained SA (SP-SM) with little silt (continued).	AND								
+		‡					1			
40		1								
+		+		2.0	7	∇	•		No Odor	
Ī		‡		2.0		\triangle				
45				2.4	8	X			No Odor	
	Bottom of Boring at 45 feet. Total Vertical Depth at 42 feet.	<u> </u>				,			Boring drilled at 21* vertical. Bearing S12.	from 5° W
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-	Asphalt		 `	Q.E.		Ť	-	<u>=0</u>	26.7	Background O	VA
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:	some gravel.		<u> </u>	'					ן ן		
5	Damp, dark brown, CLAYEY SILT (ML) v some sand.	with	* * * * *								
10											
15 -	Damp, olive, CLAYEY SILT to SILTY CL (ML-CL).	AY									
20	· ·	-									•
25		-			7.0	1	X			Slight to na o	dor.
30		- - - -			8.0	2	X			Slight to no o	dor.
35	Damp, brown, fine grained SAND (SP-SM) vilttle silt. Bottom of Boring at 35 feet. Total Vertical Depth at 31.5 feet.	with			4,6	3	X	<u></u> -		No Odor. Boring drilling at vertical. Bearing N	
	DOUGLAS AIRCRAFT					Щ			ł		<u></u>
Proje	TORRANCE	בֿב	(8T)	10) (c	Λ	F	R	ORI	NG	Fig.
Proj	oct No.: 41863B	<i>D-</i> 3	(01)	<u></u> (<i>,</i> 0	J	1	יט	J111	17 V	A-4
A/OR-	0783-235R						WC	יםסי	WARD	-CLYDE CONSULT	ANTS

	BORING LOCATION 19.3' N. Bldg. 28 & 6' N. of Excavation	(See Figure	e)	EL	EVATION O DATI	†		Not Available
	DRILLING A & R Drilling, Inc. DRILLER DRILLER	M. Smi		DA ST	ARTED		1-87	DATE 12-1-87
	DRILLING CME 75			DE	MPLETION (FL	, NC	50.6	ROCK — — — — — — — — — — — — — — — — — — —
	TYPE OF WELL CASING N/A, 7-Inch H.S.A PERFORATION	N/A		B0	AMETER RING (i	OF n.)		DIAMETER OF 7
	NO OF DIST. O UNDIST. 10	CORE	-	Lo	GCED B	ıy H. Rey	es	CHECKED BY B. Jacobs
	WATER FIRST None COMPL	24 HRS.		\perp			, 	
	_				SAMPL ORMA			
	DESCRIPTION	WELL					Drilling Rate (Time)	REMARKS
	□\$	LOG		0	ri Fi	0.V.A.	e in	
			ó	È	Blow Count	(ppm)	Rat	
	Asphalt. Moist, dark yellowish brown, SILTY SAND.						0858	Background_OVA
	<u> </u>	- 🛊				1		reading = 2-4 ppm
	Moist, dark yellowish brown, CLAY (CH).	†						
-	‡	‡	ا	Н		-		
	5 	<u> </u>	1	Δ	N/R	3	10902	No odor.
	‡	‡					1	
	‡	‡						
	Boomen vallevish beave with trace of	‡				ı		
	Becomes yellowish brown with trace of organics, decomposed roots.	†	2	M	30	3	0913	No odor.
	10+	†	_	M		_		
	‡	Ī						
	Medium dense, moist, olive brown, very fine	- 🕂						
	grained SILTY SAND (SM) to SANDY SILT (ML). ‡		Ц				
	15	1	3	M	17	10	0920	No odor.
	‡	‡		H				
	‡	‡ !						1
	†	†						
	†	Ī		Н		010	2050	NA
	20 Becomes olive gray.]	4	И	18	210	0950	Moderate hydrocarbon odor.
	†	‡						
	‡	‡						
	‡	‡ .]]				
	25	†	5	\bigvee	21	325	1005	Moderate hydrocarbon
	25	Ŧ	-	H	- '			odor.
	1	Ŧ						
	†	 			ļ			
_	‡	‡		Ц				
	30 Color phonons to dark allya brown	‡	6	XI	22	6	200	Slight to moderate
	Color changes to dark olive brown.	†		\Box				hydrocarbon.
-	<u>.</u>	1						
	Dense, moist, light olive brown, fine grained,	Ŧ						
	SILTY SAND (SM).	‡	7	М	40	6	1075	No odor.
	35‡	‡	′	И	40	U	1030	No odor.
	t les silt	†						
-	Project: DOUGLAS - TORRANCE			Ш				
	,		LO	G	OF	BORI	NG	B-4 (8T) Fig.
	Project No.: 8741863C				<u></u>			A-5
_							WUO	DWARD-CLYDE CONSULTANTS

DEPTH (feet)		WELL LOG	No.	Туре	Blow	0.V.A. (ppm)	Drilling Rate (T.)	REMARKS
40	(continued) Very dense, moist, light olive brown, fine to medium grained SAND (SP-SM) to SILTY - SAND.	† † †	8	X	56	3	1054	No odor.
† † †	Dense, very moist, yellowish brown, fine grained CLAYEY SAND (SC), with shell fragments				,	,		
45	Stiff to very stiff, alive to alive brown, SANDY SILT (ML), with Iron exide stains.	† † † †	9	X	39	12	1110	No odor.
50			10	X	36	12	1150	No odor.
+++++++++++++++++++++++++++++++++++++++	Bottom of Boring at 50.6 feet.	† † †			!			Angle drilled 22° due south.
55								
60					•			
+					;			
65					•			
†								
70								
75								
+	. ,				į		!	
80								
	ject: DOUGLAS - TORRANCE ject No.: 8741863C	CONT.	LC	Ш G	OF	BORII	VG	B-4 (8T) Fig

OCAT	ION) See F	DRILLER	M. Sm	: + h	-삼	EVATIONO DAT	10 1	7-87	Not Available 12-17-8
ORILLI AGENO ORILLI	Y NG	A & R D			<u></u>	м. 5m	ith	Si	ATE TARTED			I MAIOLICE
QUIP	EMENT			7-inch					OMPLETI PTH (f	<u> </u>	<u> 15.6</u>	ROCK
VELT.	OF CASING	N/A		SCREEN PERFORATION		N/A ORE		B g	AMETER DRING (<u>in3</u>	7	DIAMETER OF WELL (In.) CHECKED BY
lo OF SAMPL	ES	DIST.		UNDIST.	0 ,	•	_	_Ի՝	XGGED F	3. Jaco	hs	P. Glaesman
VATER DEPTH	(ft)	FIRST		COMPL	_ '2	4 HRS.		1				7. 01000111011
									SAMP			
王人						WELL		INF	ORMA	MOIT	્રે	
DEPTH (feet)		DE	SCRIPTION	N						0.V.A.	rg (Time)	REMARKS
۵`						LOG	١,	8	Blow	}	Drilling Rate	
							ż	Typ ₀	සිරි	(ppm)	28	
5-	with so	damp, redome CLAY.									0800	Background OVA reading = 4-6 ppr
10-		light olive b				† † † † † † † † † † † † † † † † † † †						
15	•	CLAT TO CLA	IEI SIEI	(ML-CL).		† † † † † † † † †	1			20		No odor.
25	Damp,	grayish olive L), with som	to olive e CLAY.	gray, SAI	NDY SILT	† † † † †	2	X		80	0845	Strong hydrocarborodor.
30	Bei	coming more	ciayey.			† † † † † †	3	X		60		Strong to moderat hydrocarbon odor.
35	Damp, some (dusky yellow CLAY.	SANDY	SILT (SM-	-ML), with	† † † † †	4	X		30	0910	Slight hydrocarbon odor.
Pra	iect DO	UGLAS AIF	CRAFT-	TORRAN	VCEI							D 5 (OT) Fi
LIO	احري			, ~, , , , , , , , , , ,			LC)G	OF	BORI	NG	0-3 (01)
D	ject No		874186		1							`

DEPTH (feet)	DESCRIPTION	WELL LOG	No.	Type	Blow Count	0.V.A. (ppm)	Drilling Rate (T.)	REMARKS
	Damp, dusky yellow, SANDY SILT (SM).							
40	Damp, moderate brown to moderate yellowish brown, fine grained SAND (SP), with little silt.		5	X		9	0930	No odor.
15			6	V		7	0045	No odor.
45		,		Ц			0373	L
† †	Bottom of Boring at 45.6 feet.	_						Note: Angle drilled at 22° due south.
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ŧ	†					:		
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80		-						
†	<u>†</u>	}						
	BOUGH AS ASSOCIATE TORSE ASSOCIATE			Ш				
		CONT.	LC	G	OF	BORI	NG	B-5 (8T) Fi
Proj	ject No.: 8741863C						uinn	DWARD-CLYDE CONSULTANTS

APPENDIX C MACCO ANALYTICAL RESULTS



certified testing laboratories, inc.

2905 EAST CENTURY BLVD. . SOUTH GATE, CALIF. 90280 . (213) 564-2641

	T ANOD LEGODY NO	05670	DEDODTED 02 22 07
	- LABOKATOKI - NO	85679	REPORTED03-23-87.
	CLIENT	Mc Donnell Douglas 19503 S. Normandie Avenue	SAMPLED
		Torrance, CA 90502 Attn: Don Gerber	RECEIVED 03-12-87
		C6-13	
_	SAMPLE	Soil	
	MARKS	03-11-87 11:00 am 8T Salvage yard P.O.	. #7BZ683591
	BASED ON SAMPLE	As received	
	RESULTS	Method 418.1	
		South End of Tank <15	mg/Kg
		North End of Tank 2000	mg/Kg

Respectfully submitted, CERTIFIED TESTING LABORATORIES, INC.

Stuart E. Salot, Ph.D.

his report applies only to the sample, or samples, investigated and is not necessarily indicative of the quality or condition of apparently dentical or similar products. As a mutual protection to clients, the public and these Laboratories, this report is submitted and accepted for The exclusive use of the client to whom it is addressed and upon the condition that it is not to be used, in whole or in part, in any advertising or publicity matter without prior written authorization from these Laboratories.



RECEIVED MAR 1 8 1987

GEOTEST

An Environmental Monitoring and Testing Service

FIELD LABORATORY RESULTS REPORT

PREPARED FOR

CONCRETE CUTTING - MCDONNELL DOUGLAS

ANALYSIS OF HYDROCARBON CONTENT BY INFRARED SPECTROMETRY EPA METHOD 418.1

DATE RECEIVED

March 11, 1987

DATE OF ANALYSIS

March 11, 1987

PROJECT NUMBER

86515-04

SAMPLE ID #

CONCENTRATION

(mg/kg)

86515-04-1

1.4 So. END 21

86515-04-2

270. FILL END 2' (NORTH

Analyst: RB

Reviewed & Approved: Ker Newsonbe-Dierl

*NOTE: Samples were received in a chilled state, intact and with

Chain-of-Custody attached.



GEOTEST

An Environmental Monitoring and Testing Service

PIELD LABORATORY RESULTS REPORT

PREPARED FOR

CONCRETE CUTTING - MC DONNELL DOUGLAS

ANALYSIS OF HYDROCARBON CONTENT BY INFRARED SPECTROMETRY

EPA METHOD 418.1

DATE RECEIVED :
DATE OF ANALYSIS :
PROJECT NUMBER :

03/17/87

03/17/87 86513-04

SAMPLE ID #

CONCENTRATION

(mg/kg)

86513-04-03

3286. FILL END 4

86513-04-04

1725.

(ج)

Analyst:

Reviewed & Approved:

*NOTE: Samples were received in a chilled state, intact and with Chain-of-Custody attached.

GEOTEST is a division of GEOSERVICES, a California corporation

Post Office Box 90911 Long Beach, California 90809-0911 (213) 498-9515 (800) 624-5744

APPENDIX D WCC ANALYTICAL RESULTS

April 17, 1987

WOODWARD-CLYDE 203 N. Golden Circle Drive Santa Ana, CA 92705

Attn: Allistair Callendar

JOB NO. 5664



ANALYTICAL CHEMISTS

LABORATORY REPORT

Samples: Forty (40) soil samples Date Received: 4-10-87

Purchase Order No: Project 41863B

Fifteen (15) soil samples were analyzed for hydrocarbon content according to a modified EPA method 8015. The results are reported in the following table.

Page 1 of 2

Jim Bonde Senior Chemist

B. Muls Hor

D.J. Northington, Ph.D. Technical Director

WEST COAST ANALYTICAL SERVICE, INC.

Woodward-Clyde Mr. Allistair Callendar Job # 5664 April 17, 1987

LABORATORY REPORT

Parts Per Million

Sample No.	<u>Gasoline</u>	Diesel <u>Fuel</u>	<u>Kerosene</u>	Mineral <u>Spirits</u>	C ₁₈ -C ₃₀₊ Hydrocarbon
B1-1-3-3	ND	ND	3030	ND	1300
B1-1-5-3	ND	ND	ND	ND	ND
B1-1-6-3	ND	ND	ND	ND	ND
B1-1-7-3	ND	ND	ND	ND	ND
B2-2-2-3	ND	ИD	ND	ND	ND
B2-2-3-3	ND	ND	ND	ND	ИD
B2-2-4-3	ND	ND .	9500	ND	9700
B2-2-5-3	ND	ND	1900	ND	2800
B2-2-7-3	ND	ND	ND	ND	ND
.B3-3-1-3	ND	ND	ND	ND	ИD
B3-3-2-3	ND	ND	ND.	ND	ИD
B3-3-3-3	ND '	ND	ND	ND	ИD
SP-1	ND	ND	ND	ND	310
Detection					
Limit	10	10	10	10	100
Sample		Diesel		Mineral	C9-C30+
No.	<u>Gasoline</u>	<u>Fuel</u>	<u>Kerosene</u>	<u>Spirits</u>	Hydrocarbon
B2-2-6-3	ND	ND	ND	ND	4600
SP-2 Detection	ND	ND	ND	ND	680
Limit	10	10	10	10	100

Date Analyzed: 4-16-1987

ND - Not Detected

Page 2 of 2

December 9, 1987

WOODWARD-CLYDE CONSULTANTS 203 N. Golden Circle Dr. Santa Ana, CA 92705

Attn: Alistaire Callender

JOB NO. 7933

#A#

LABORATORY REPORT

Samples Received: Twenty-eight (28) soil samples

Date Received: 12-2-87

Purchase Order No: 8741863C

The samples were analyzed as follows:

Samples Analyzed Analysis Results

Eight (8) soil Fuel Hydrocarbons by modified EPA 8015

Page 1 of 2

James Bonde Senior Chemist D.J. Northington, Ph.D. Technical Director

WEST COAST ANALYTICAL SERVICE, INC.

WOODWARD-CLYDE CONSULTANTS Mr.Alistaire Callender

Job # 7933 December 9, 1987

LABORATORY REPORT

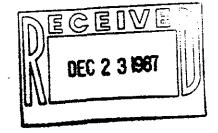
TABLE I Parts Per Million

Sample No.	<u>Gasoline</u>	Mineral Spirits	Kerosene	Diesel <u>Fuel</u>	C ₂₀ -C ₃₀ Hydrocarbons
7-3-3	ИD	ND	ND	ИD	ND
7-4-3	ND	ND	ND	ND	ND
7-5-3	ND	ND	6400	ND	27,000
7-6-3	ND	ND	72	ND	360
7-7-3	ND	ND	ND	ИD	ND
8TPL-3	ND	ND	ND	ND	TR
8TPL-5	ND	ND	ND	ND	ND
STPL-7	ND	ND	ND	ND	ND
Detection Limit	10	10	10	10	100

ND-Not Detected TR-Trace

Date Analyzed: 12-7-87 to 12-8-87 Page 2 of 2

December 22, 1987



WEST COAST **ANALYTICAL** SERVICE, INC.

ANALYTICAL CHEMI***

"F"

JOB NO. 8092

WOODWARD-CLYDE

LABORATORY REPORT

Samples Received: Thirteen (13) soil samples

Date Received: 12-17-87

203 N. Golden Circle Drive

Attn: Alistaire Callendar

Santa Ana, CA 92705

Purchase Order No: 8741863C/Douglas Aircraft

The samples were analyzed as follows:

Samples Analyzed Analysis Results

8 soils Fuel Hydrocarbons by

Modified EPA 8015 Table I

TABLE I

Parts Per Million

<u>Sample</u>	<u>Gasoline</u>	Mineral <u>Spirits</u>	<u>Kerosene</u>	Diesel <u>Fuel</u>	C ₂₀ -C ₃₀ Hydrocarbons
1	ND	ND	ND	ND	550
2	ND	ND	ND	ND	540
3	ND	ND	ND	ND	ND
B-5-1-3	ND	ND	ND	ND	ND
B-5-2-4	ND	ND	150	ND	1000
B-5-3-3	ND	ND	1100	ND	5800
B-5-4-3	ND	ND	4200	ND	5900
B-5-5-3	ND	ND	ND	ND	ND
Detection	n				
Limit	10	10	10	10	- 100

Date Analyzed: 12/19-20/87 Page 1 of 1

> James Bonde Senior Chemist

D.J. Northington, Ph.D. Technical Director

January 6, 1988

WOODWARD-CLYDE

203 N. Golden Circle Drive Santa Ana, CA 92705

Attn: Allistair Callendar

JOB NO. 8216

LABORATORY REPORT

Samples Received: Five (5) soil samples

Date Received: 1-5-88

Purchase Order No: Proj: 8741863C/Douglas Aircraft

The samples were analyzed as follows:

Samples Analyzed	<u>Analysis</u>	Results
Five soils	Fuel Hydrocarbons by modified EPA 8015	Table I

TABLE I

Parts Per Million

Sample No.	<u>Gasoline</u>	Mineral Spirits	<u>Kerosene</u>	Diesel <u>Fuel</u>	C ₁₅ -C ₃₀ <u>Hydrocarbons</u>
SP-1	ND	ND	ND	ND	ND
SP-2	ND	ND	ND	ND	160
SP-3	ND	ND	ND	ND	ND
SP-4	ND	ND	ND	ND	ND
SP-5	ND	ND	ND	ND	ND
	imit 10	10	10	10	100

ND - Not Detected

Date Analyzed: 1-5-88 Page 1 of 1

James Bonde Senior Chemist D.J. Northington, Ph.D. Technical Director

January 14, 1988

WOODWARD-CLYDE

203 N. Golden Circle Drive

Santa Ana, CA 92705

Attn: Allistair Callendar

JOB NO. 8253



ANALYTICAL CHEMIS

LABORATORY REPORT

Samples Received: One (1) soil sample in duplicate & one (1)

water sample in duplicate

Date Received: 1-8-88

Purchase Order No: 8741863C-1000/Douglas Aircraft

The samples were analyzed as follows:

Samples Analyzed <u>Analysis</u> Results

One water Volatile Organics

Data Sheets by EPA 8240

One soil Fuel Hydrocarbons by

Table I modified EPA 8015

TABLE I

Parts Per Million

Sample No.	<u>Gasoline</u>	Diesel <u>Fuel</u>	<u>Kerosene</u>	Mineral <u>Spirits</u>
Trench 1A	ND	ND	ND	ND
Detection Limit	10	10	10	10

ND - Not Detected

Page 1 of 1 Date Analyzed: 1-11-88

Michael Shelton

Senior Chemist

ゴ. Northington, Ph. D. Technical Director

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APPENDIX E

LETTER TO L.A. REGIONAL WATER QUALITY CONTROL BOARD

Woodward-Clyde Consultants

4 January 1988 Project No. 8741863C

Mr. Jeff Copeland Regional Water Quality Control Board Los Angeles Region 107 south Broadway, Room 4027 Los Angeles, California 90012

SUBJECT: PROPOSED REMEDIATION AT TANK ST AT THE DOUGLAS AIRCRAFT COMPANY'S TORRANCE FACILITY

Dear Mr. Copeland:

The purpose of this letter is to present to the Regional Water Quality Control Board a method of remediating the petroleum hydrocarbons present in the Tank 8T excavation at the Torrance facility of Douglas Aircraft Company. The approach described in this letter was discussed at a meeting on 21 December 1987 between you, Kent Adams and Melissa Henck of Douglas Aircraft Company, and Alistaire Callender of Woodward-Clyde Consultants.

subsequent explained at the meeting and during a conference call on Wednesday, 23 December 1987 between you, Alistaire Callender and Melissa Henck, we propose excavating soil with total petroleum hydrocarbon concentrations greater than 1,000 mg/kg, and disposing of this soil at a landfill permitted to accept it. Soil with petroleum hydrocarbon concentrations less than 1000 mg/kg may be left in place, if excavating deep enough to remove it will threaten the stability of the building adjacent to the excavation. samples will be collected from the sides and bottom of the excavation, to evaluate the concentrations of petroleum hydrocarbons left in place. No soil with total petroleum hydrocarbon concentrations greater than 1,000 mg/kg will be left in place. In addition the total petroleum hydrocarbon analyses, two samples from the bottom of the excavation will analyzed by modified 8015, EPA concentrations of BTXE in the soil.

The excavation will be backfilled with lean concrete to 5 feet below ground surface, and then brought up to the surface using clean compacted soil previously removed from the hole. The excavation will be backfilled with lean concrete to reduce settlement. If soil were to be used to backfill the hole, it would be necessary to shore the excavation prior to anyone entering the hole to run compaction tests. These tests will be necessary to confirm

Consulting Engineers. Geologists and Environmental Scientists

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Woodward-Clyde Consultants

Mr. Jeff Copeland

4 January 1988

that the required level of soil compaction had been achieved. With lean concrete, no compaction tests will be necessary except from the surface to a depth of two feet. No shoring is required in an excavation of this depth.

Soil put back into the excavation will have petroleum hydrocarbon concentrations less than 100 mg/kg. Most of the soil already excavated contains hydrocarbon concentrations of less than 10 mg/kg. Once the excavation has been filled and compacted, a low permeability asphalt cover will be put in place. This asphalt cover will incorporate a fabric liner, which will increase its strength and reduce its water permeability.

The bottom of the excavation will be sampled, and the samples analyzed for hydrocarbons, prior to backfilling. The results of the soil analyses and compaction tests will be submitted to the LARWQCB for review after the job has been completed. The Board will be kept verbally appraised of the remediation as it progresses.

Very truly yours,

Alistan Palle de

WOODWARD-CLYDE CONSULTANTS

Alistaire Callender, Ph.D.

Project Manager (ABC/Copeland)

AC:1k

cc: Janet Bell, Douglas Aircraft Company Ben Warren, Douglas Aircraft Company Bob Fassbender, Douglas Aircraft Company 203 North Golden Circle Drive Santa Ana, CA 92705 (714) 835-6886 (213) 581-7164 Telex 68-3420

Woodward-Clyde Consultants

January 18, 1988 Project No. 8741863C

Mr. Jeff Copeland California Regional Water Quality Control Board Los Angeles Region 107 South Broadway, Room 4027 Los Angeles, California 90012

SUBJECT: REMEDIATION PROPOSAL FOR TANK ST EXCAVATION AT DOUGLAS AIRCRAFT COMPANY'S TORRANCE

(C6) FACILITY

Dear Mr. Copeland:

I would like to confirm your approval of the remedial measures proposed for the Tank 8T excavation at Douglas Aircraft Company's Torrance (C6) facility. The plan approved by you was described in the letter of December 28, 1987 submitted to the Regional Water Quality Control Board. Your approval was given via a telephone call on December 31, 1987.

There exists some ambiguity as to what levels of petroleum hydrocarbon RWQCB may consider a threat to ground water. Regardless, Douglas Aircraft Company intends to proceed conservatively in the instance and tentatively plans on removing soil with hydrocarbon concentrations greater than 100 mg/kg.

Sincerely yours,

WOODWARD-CLYDE CONSULTANTS

Alistaire Callender, Ph.D.

Project Manager

Alsten Rallader

AC:1k (ABC/ABC-002)

cc: Janet Bell, Douglas Aircraft Company
 Melissa Henck, Douglas Aircraft Company
 Bob Fassbender, McDonnell Douglas
 Kent Adams, Douglas Aircraft Company

Consulting Engineers Geologists and Environmental Scientists

Offices in Other Principal Cities

